

What is claimed is :

1. A selective reduction type high temperature superconductor characterized in that the high temperature superconductor has a portion  
5 of its constituent elements selectively reduced whereby it has a superconducting layer thereof doped with positive holes.

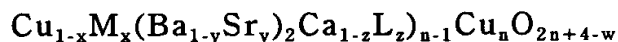
2. A selective reduction type high temperature superconductor as set forth in claim 1, characterized in that said high temperature  
10 superconductor has a portion of its constituent elements selectively reduced whereby there are formed in superconducting layers a first and a second region doped overly and doped optimally with superconducting carriers, respectively.

3. A selective reduction type high temperature superconductor as set forth in claim 1 or claim 2, characterized in that said high  
15 temperature superconductor has a portion of its constituent elements selectively reduced whereby the superconductor as a whole has a superconducting carrier concentration such that it is held doped overly or doped optimally with superconducting carriers.  
20

4. A selective reduction type high temperature superconductor as set forth in claim 1, claim 2 or claim 3, characterized in that said  
25 superconductor has on each of an upper and a lower surface of a unit cell thereof a charge supply layer having each of a portion of Cu atoms substituted with a selectively reducible atom.

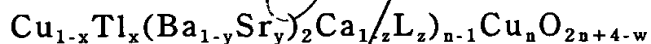
5. A selective reduction type high temperature superconductor as set forth in claim 1, claim 2 or claim 3, characterized in that said  
30 superconducting layers have an upper and a lower surface constituted by a  $\text{CuO}_2$  surface of 5-coordination and a surface other than the upper and lower constituted by a  $\text{CuO}_2$  surface of 4-coordination.

6. A selective reduction type high temperature superconductor as set forth in claim 1, claim 2 or claim 3, characterized in that it is made of a (Cu, M) family high temperature superconducting material that can be described by composition formula:



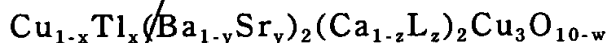
where M represents ions of one or more polyvalent metallic elements selected from the class which consists of Tl, Bi, Pb, In, Ga, Sn, Ti, V, Cr, Mn, Fe, Co, Ni, Zr, Nb, Mo, W, Re and Os; L represents one or more elements selected from the class which consists of Mg and alkaline metallic elements;  $0 \leq x \leq 1.0$ ;  $0 \leq y \leq 1$ ;  $0 \leq z \leq 1$ ;  $0 \leq w \leq 4$ ; and  $1 \leq n \leq 16$ .

7. A selective reduction type high temperature superconductor as set forth in claim 1, claim 2 or claim 3, characterized in that it is made of a (Cu, Tl) family high temperature superconducting material that can be described by composition formula:



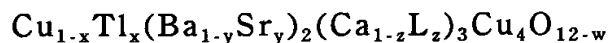
where L represents one or more elements selected from the class which consists of Mg and alkaline metallic elements;  $0 \leq x \leq 1.0$ ;  $0 \leq y \leq 1$ ;  $0 \leq z \leq 1$ ;  $0 \leq w \leq 4$ ; and  $1 \leq n \leq 16$ .

8. A selective reduction type high temperature superconductor as set forth in claim 1, claim 2 or claim 3, characterized in that it is made of a (Cu, Tl) family high temperature superconducting material that can be described by composition formula:



where L represents one or more elements selected from the class which consists of Mg and alkaline metallic elements;  $0 \leq x \leq 1.0$ ;  $0 \leq y \leq 1$ ;  $0 \leq z \leq 1$ ; and  $0 \leq w \leq 4$ .

9. A selective reduction type high temperature superconductor as set forth in claim 1, claim 2 or claim 3, characterized in that it is made of a high temperature superconducting material that can be described by composition formula:



where L represents one or more elements selected from the class which consists of Mg and alkaline metallic elements;  $0 \leq x \leq 1.0$ ;  $0 \leq y \leq 1$ ;  $0 \leq z \leq 1$ ; and  $0 \leq w \leq 4$ .

10. A selective reduction type high temperature superconductor as set forth in any one of claims 1 to 9, characterized in that the concentration of superconducting carriers is adjusted by selective reduction or by varying (increasing or decreasing) oxygen concentration.

11. A selective reduction type high temperature superconductor as set forth in claim 6, characterized in that it is a selectively over-doped type or a selectively optimum-doped type, high temperature superconductor in which n is any one of 3, 4, 5, 6 and 7.

12. A selective reduction type high temperature superconductor as set forth in any one of claims 1 to 11, characterized in that selective reduction causes said substitutional ions in a said charge supply layer to receive electrons in their outer shell orbits, thereby providing holes in the  $\text{CuO}_2$  surface of 5-coordination of a said superconducting layer.

13. A selective reduction type high temperature superconductor as set forth in any one of claims 1 to 12, characterized

in that it has a superconducting anisotropy of not greater than 10, and a coherence distance of not less than 3 angstroms.

5 14. A selective reduction type high temperature superconductor as set forth in any one of claims 1 to 13, characterized in that said selective reduction transforms its natural superconducting wave function that is of a d-wave to a wave function of a  $(d + is)$  wave that has also a property of an s-wave.

10 15. A method of making a selective reduction type high temperature superconductor, characterized in that it comprises the steps of:

preparing a high temperature superconductor, and  
15 heat-treating the prepared high temperature superconductor in a reducing atmosphere.

16. A method of making a selective reduction type high temperature superconductor, comprising the steps of:

20 using an amorphous film as a precursor of high temperature superconductor;

causing the amorphous film to grow epitaxially by amorphous phase epitaxy; and

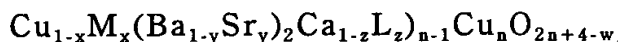
25 heat-treating in a low oxygen, reducing atmosphere the amorphous film that has grown epitaxially.

17. A method of making a selective reduction type high temperature superconductor, comprising the steps of:

causing added constituent elements to develop their self-forming effect; and

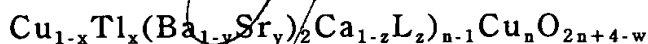
30 causing the high temperature superconductor to grow epitaxially by the self-forming effect.

18. A method of making a selective reduction type high temperature superconductor as set forth in any one of claims 15 to 18, characterized in that it is applicable to making a (Cu, M) family selective reduction type high temperature superconductor expressed by composition formula:



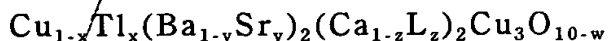
where M represents ions of one or more polyvalent metallic elements selected from the class which consists of Tl, Bi, Pb, In, Ga, Sn, Ti, V, Cr, Mn, Fe, Co, Ni, Zr, Nb, Mo, W, Re and Os; L represents one or more elements selected from the class which consists of Mg and alkaline metallic elements;  $0 \leq x \leq 1.0$ ;  $0 \leq y \leq 1$ ;  $0 \leq z \leq 1$ ;  $0 \leq w \leq 4$ ; and  $1 \leq n \leq 16$ .

19. A method of making a selective reduction type high temperature superconductor as set forth in any one of claims 15 to 17, characterized in that it is applicable to making a (Cu, Tl) family selective reduction type high temperature superconductor expressed by composition formula:



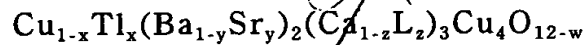
where L represents one or more elements selected from the class which consists of Mg and alkaline metallic elements;  $0 \leq x \leq 1.0$ ;  $0 \leq y \leq 1$ ;  $0 \leq z \leq 1$ ;  $0 \leq w \leq 4$ ; and  $1 \leq n \leq 16$ .

20. A method of making a selective reduction type high temperature superconductor as set forth in any one of claims 15 to 17, characterized in that it is applicable to making a (Cu, Tl) family selective reduction type high temperature superconductor expressed by composition formula:



where L represents one or more elements selected from the class which consists of Mg and alkaline metallic elements;  $0 \leq x \leq 1.0$ ;  $0 \leq y \leq 1$ ;  $0 \leq z \leq 1$ ; and  $0 \leq w \leq 4$ .

21. A method of making a selective reduction type high temperature superconductor as set forth in any one of claims 15 to 17, characterized in that it is applicable to making a selective reduction  
5 type high temperature superconductor expressed by composition formula:



where L represents one or more elements selected from the class which consists of Mg and alkaline metallic elements;  $0 \leq x \leq 1.0$ ;  $0 \leq y \leq 1$ ;  $0$   
10  $\leq z \leq 1$ ; and  $0 \leq w \leq 4$ .